Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

April 1964

U.S. FOREST SERVICE
RESEARCH NOTE RM - 17

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Estimating Number of Visitors to

National Forest Campgrounds

Larry W. Tombaugh[1] and L. D. Love[2]

Foresters are concerned with accurate statistics on the amount and kinds of use made of various recreation areas.[3] Since count of every visitor to all areas is not possible, a reliable method of estimating use is needed.

Visitor-use figures are used to:

1. establish schedules for visitor information programs, road maintenance, and trash disposal,
2. predict depreciation rates of facilities,
3. determine the need for enlarging campgrounds, and
4. identify trends and patterns of use.

Estimates of visitor use are difficult to obtain because recreation is not a static entity, but a dynamic interplay of people, areas, and activities.

In this study, three methods currently used to estimate the number of visitors to National Forest campgrounds were evaluated:

1. sporadic counts by recreation guards,
2. automatic traffic-counter readings converted to visitor numbers, and

3. estimates by field personnel (ranger estimates).

In addition, improvements in the first two methods are proposed.

PROCEDURES

Comparisons of the three methods were limited to 12 selected campgrounds in National Forests of Arizona, New Mexico, Colorado, Wyoming, and South Dakota. At each campground, visitors and vehicles were counted for two 4-day periods covering a Friday-through-Monday sequence. For the same 4-day periods, estimates of visitor numbers were obtained from personnel of the National Forests.

At all campgrounds, a daily-use record was made for each unit (table, fire grate, and trash container in a localized spot within a forest campground). All units were observed from 8:00 a.m. until 7:00 p.m. on Friday through Sunday, and from 8:00 a.m. until 5:00 p.m. on Monday. A record was also kept of the off-unit users--those who entered a campground but did not use a designated unit. Visi-

tors were counted only once for as long as they remained and used the campground.

The estimates of visitor numbers by the three methods were compared with the actual numbers of visitors (including off-unit users) to the campgrounds. Because the estimating methods and the actual counts were both measuring the same population--numbers of visitors--they were statistically treated as paired data. (All statistical procedures are based on Snedecor.[4]) Standard deviations of mean differences and coefficients of variation were computed for each of the three methods. Table 1 shows these comparisons along with the variation in the accuracy of the estimating methods.

Table 1.--Comparison of actual count with three methods used to estimate numbers of visitors

Method vs. count	Mean difference	Standard deviation	Coefficient of variation
			Percent
Recreation guard (on two camp- grounds for one 4-day period, and one campground for two 4-day periods)	128.00	460.10	359.5
Traffic counter (on four camp- grounds for two 4-day periods)	666.38	605.77	90.9
Ranger estimates (on two camp- grounds for two 4-day periods and two campgrounds for three 4-day periods)	1,255.60	1,988.44	158.4

PROPOSED METHODS

The size of the coefficients of variation indicates that the present techniques for esti- mating visitors are not producing consistent and reliable results, and require modifica- tions. For the purposes of this study, little can be done to improve the ranger-estimate

method of determining visitor numbers; thus, the remainder of the discussion will deal with recreation-guard counts and traffic-counter estimates.

Simulated Recreation-Guard Count

From the daily-use records, which show the number of visitors occupying each unit of the various campgrounds on an hourly basis, a recreation-guard count was simulated by choosing a specific time of day and totaling the number of people at each unit at that time. Four times of day were chosen so as to rep- resent a morning count, a noon count, and an early-and late-afternoon count. Arbitrarily, 10:00 a.m., 12:00 noon, 3:00 p.m., and 5:00 p.m. were chosen.

In a highly controlled study, visitors from day to day are recognized by close and nearly continuous observation. Under actual field conditions, however, it is difficult for a rec- reation guard who only visits a campground once a day to remember the individual people occupying each unit. Therefore, in simulating a recreation-guard count, the visitor who camped from Saturday through Monday was counted three times to simplify the procedure and to eliminate one source of error. No off- unit users were considered.

The simulated recreation-guard counts for the 96 observation days were compared with the actual total counts from the daily use rec- ords for the corresponding days. To deter- mine which time of day yields the most reliable recreation-guard counts, correlation coefficients were computed for each of the four selected times:

Time of day	Correlation coefficient (r)
10:00 a.m.	0.732**
12:00 noon	.780**
3:00 p.m.	.759**
5:00 p.m.	.681**
**Significant at the 1 percent level.	

These coefficients indicate that the counts made between 10:00 a.m. and 3:00 p.m. are most closely related to the actual numbers of people on the campground for the entire day.

The 12:00 noon and 3:00 p.m. counts are preferable, because a 10:00 a.m. count appears to miss a higher proportion of the visitors.

Simulated Traffic-Counter Estimate

The type of counter being simulated was one of the many types commonly used by State highway departments and cities to determine traffic volumes.[5] One such counter was assumed to be installed at each of the campgrounds under study and read at 5:00 p.m. daily. This type of instrument actually records the number of vehicle axles that enter and leave a campground. In this study, all motorized vehicles were assumed to have two axles and all trailers to have one axle.

In simulating counter readings, each motorized vehicle that entered and left a campground before 5:00 p.m. on any day (determined from daily-use records) was recorded as four "pips"--two as the vehicle entered and two as it left. If this same vehicle had been pulling a trailer, three "pips" would have been recorded in and three out. A "pip" is equivalent to a unit increase on the counter meter due to a single axle crossing the pneumatic activator. All vehicles present at a unit at 8:00 a.m. on a Friday were treated as though they had arrived after 5:00 p.m. on the preceding day. If, for example, an automobile was present at 8:00 a.m. on a Friday and did not leave until 7:00 p.m., two "pips" were recorded for that vehicle on Friday and two on Saturday. Any vehicle that entered a campground after 5:00 p.m. was credited to the next day.

A traffic counter actually installed at a campground would record all vehicles entering and leaving regardless of whether the occupants of the vehicles made use of the campground. For this reason, off-unit use was included in the simulated traffic-counter counts to approximate field conditions. Simulations were made for each day of both periods for all campgrounds, 96 in all.

The correlation coefficient between the simulated traffic-counter estimates and the total number of visitors for the corresponding day was 0.807 (significant at the 1 percent level). Traffic-counter estimates accounted for 65.1 percent of the variation in the total number of visitors counted per day. Compared with 60.8 percent for the simulated 12:00 noon recreation-guard count, the traffic-counter estimate was more precise.

Regression Analyses

The simulated 12:00 noon recreation-guard count did not identify those visitors who stayed more than 1 day. Each day's count was independent of the next. A regression analysis gives the following prediction equation:

$$Y = 43.68 + 0.846 \, X_1 \qquad (1)$$

where Y is the total number of visitors at units for any 1 day, and X_1 is the number of people counted at 12:00 noon of that day by the recreation guard. The regression coefficient (0.846) is significant at the 1 percent level. The standard error of estimate is ± 72.85 visitors.

The simulated traffic-counter estimates measure total daily (5:00 p.m.) axle crossings. A regression analysis gives the following prediction equation:

$$Y = 18.44 + 0.494 \, X_2 \qquad (2)$$

where Y is the total number of visitors at units for any 1 day and X_2 is the traffic counter reading in total axle crossings for that day read at 5:00 p.m. The regression coefficient (0.494) is significant at the 1 percent level. The standard error of estimate is ± 68.73 visitors.

The two prediction equations are averages of 12 campgrounds and may not apply specifically to any one campground.

APPLICATION OF METHODS

Estimates of total number of visitors to a recreation site by recreation guards or by means of traffic counters vary considerably. Errors often exceed the mean values. By means of regression equations, these estimates can be improved and the errors reduced.

In applying the recreation-guard count method, the people at each unit of a campground should be systematically and carefully counted at 12:00 noon every day, regardless of whether they had been counted the previous day. The regression equation corrects for recounts and thus eliminates the necessity of remembering individual parties and their length of stay. Equation (1) estimates the total number of visitors to a campground for the day the noon count is made. The equation should be checked periodically by actually counting the total number of visitors to a campground as well as just those at 12:00 noon.

Equation (2) for the traffic-counter method tends to average a number of variables. Some of these include the amount of off-unit use, the number of times campers leave and enter the campground during their stay, the ratio of trailers to motorized vehicles, and the average number of people per vehicle. The effect of these variables on estimates varies considerably among campgrounds and seasons. For this reason, a traffic counter should be calibrated upon installation and periodically thereafter. Major changes in the character of the campground will probably necessitate re-calibration. To calibrate a traffic counter, total visitors to a campground should be counted the same time that a traffic counter is recording the number of axles (read at 5:00 p.m.).

[1] Graduate student, College of Forestry and Range Management, Colorado State University, Fort Collins, Colorado.

[2] Research Forester, Rocky Mountain Forest and Range Experiment Station with headquarters at Fort Collins, Colorado, maintained in cooperation with Colorado State University.

[3] James, G. A. and Ripley, T. H. 1963. Instructions for using traffic counters to estimate recreation visits and use. U. S. Forest Serv. Res. Paper SE-3, 12 pp. Southeast Forest and Range Expt. Sta., Asheville, N. C.

[4] Snedecor, G. W. 1956. Statistical Methods. Ed. 5, 534 pp. Ames: Iowa State University Press.

[5] Marcus, L. F., Gould, E. M., Jr., and Bury, R. L. 1961. Measuring the recreation use of National Forests. U. S. Forest Serv. Pacific Southwest Forest and Range Expt. Sta. Tech. Paper 59, 26 pp.

Agriculture --- CSU, Ft. Collins